Cortical Microstimulation

And Other Neurocognitive Rehabilitation Techniques

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The field of biomedical engineering is a rapidly expanding and oft dividing study. Once there was neurotechnology. Today, the name is too broad to describe the entirety of the research taking place in that field. One branch of neurotechnology is concerned with Neurocognitive Prostheses. It explores the possibility of not simply restoring a piece of the peripheral nervous system, but rather at restoring brain function on the order of cognition, language, memory and executive planning.

While much of today's neurotechnology has begun to bridge gaps in the peripheral nervous system, researchers are also focusing on restoring cognitive function with a variety of techniques. Behavioral techniques, such as assistive devices, offer some assistance, and are currently in use by many patients suffering from the debilitating effects of neurological diseases. For instance, something as simple as a pocket notebook or photo album could be considered an assistive device. Virtual reality is also emerging as a safe way to practice household tasks without risk.

The next step after these possible behavioral techniques are non-invasive modulations of brain functions. Various methods are in the testing stage for this level of Neurocognitive restoration, such as visual entrainment, in which pulses of light are used to stimulate neural impulses, transcranial magnetic stimulation (TMS), transcranial direct current stimulation (tDCS), and neurofeedback, among others. Each of these techniques has their own pros and cons, but appears promising in terms of potential benefits.

Invasive techniques, often considered a last resort, are also being considered. Frequency/contingent learning, cell-triggered recall, subcortical/peripheral stimulation, and ectopic neural modules, as well as cortical microstimulation are all being considered as invasive modulations. Again, each of these varied techniques has their drawbacks, and show great promise. Microstimulation of the temporal cortex is perhaps one of the more interesting and promising techniques being researched today.

Exploiting the link between certain neuron collections, known as ensembles, in the temporal cortex and their associated memories, cortical microstimulation has been considered as a guide for therapeutic resection to treat refractory epilepsy. By stimulating certain ensembles, one can locate the focus of the seizure within the cortex. However, this modulation shows promise in other applications as well. In some cases, gross microstimulation of the ensembles produced incredibly vivid memories, being "replayed" for a patient, analogous to a tape player. Perhaps researchers can use this exciting link in applications such as memory neuroprosthetics, allowing Alzheimer's patients recall memories they thought were lost.

Sources:
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